AERONOMY LABORATORY

Boulder, Colorado

Mission

The mission of the Aeronomy Laboratory (AL) is to improve the understanding of the chemical, dynamical and radiative processes of the Earth's atmosphere that are needed to improve NOAA's capability to predict its behavior. The chemical, dynamical, and radiative processes of the atmosphere are the mechanisms of atmospheric change. As such, their identification and characterization are a fundamental necessity for building better models for predicting the behavior of regional and global phenomena, which is at the heart of NOAA's mission.

- The Aeronomy Laboratory currently focuses on understanding the atmospheric processes important to model predictions of changes in climate, regional air quality, and the stratospheric ozone layer.

- In this user information context, Aeronomy Lab scientists conduct investigations of the atmospheric process under controlled conditions in the laboratory, carry out field measurements in a variety of environments, and use diagnostic models for analyses and interpretations.

- The Aeronomy Laboratory also assesses the current state of scientific understanding and interacts with those who use this information both within NOAA and elsewhere.

Brief History

The Aeronomy Laboratory was formed in 1965. Over AL's nearly 40 year time span, its research has evolved to meet a sequence of most-pressing national needs for scientific understanding of atmospheric chemistry and related air motions. It initially focused on the chemistry and motions of the upper atmosphere's ionosphere, in response to the Nation's need for scientific information that would enable advances in radio communications and matters of national security. In the 1970s, AL's research shifted to the chemistry of the lower layers of the atmosphere as the national environmental issues of stratospheric ozone depletion and acidic deposition emerged. Over the recent decade, AL's research foci have included the chemical processes that control the characteristics of greenhouse gases and aerosols in the lower atmosphere and that control surface-level ozone pollution episodes.

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Financial Profile (In thousands of dollars)

Fiscal Year	Permanent Funding	Other NOAA	Non-NOAA	Pass Through		TOTAL B/	
FY 2001	6355.6	5918.4	729.6	1524	A	13003.6	B
FY 2002	7074.5	6116.8	1367.9	2988	A	14559.2	B
FY 2003	6877.4	6800.4	803.6	4355	A	14481.4	B

A/ - To AIRMAP

B/ - Total funding w/o AIRMAP passthrough

Personnel Data

FY	FEDERAL EMPLOYEES	JOINT INSTITUTE	Contractors	TOTAL
FY 2000	46	64	0	110
FY 2001	44	60	0	104
FY 2002	45	62	0	107
FY 2003	42 *	61 *	0	103

* 4 are part time

* 8-9 are part time

Average Age Federal/Scientific/Engineering and Technical Staff	51.6
Average Age of JI/Scientific/Engineering and Technical Staff	40

Federal Staff	PhD	56%	MS	5%
JI Staff	PhD	67%	MS	5%

AERONOMY LABORATORY
PARTNERSHIPS

PARTNERSHIPS	IDENTIFY (and explain)
JOINT INSTITUTES	●*Cooperative Institute for Research in Environmental Sciences (CIRES).* Associated with the University of Colorado in Boulder, this close research partnership has spanned over 30 years. More than 50% of Aeronomy Laboratory personnel are affiliated with CIRES. Research partnerships are in the areas of climate, air quality, and ozone-layer science. ●*Atmospheric Investigation, Regional Modeling, Analysis and Prediction (AIRMAP).* AIRMAP is NOAA's Joint Institute associated with the University of New Hampshire. The Aeronomy Laboratory has had a very fruitful collaboration with AIRMAP researchers since 1999. Major cooperative efforts include the New England Air Quality Study of 2002, which was the most comprehensive air quality study ever conducted to gain insights into the underlying causes of poor air quality in the northeastern U.S. An even more detailed study is planned for summer of 2004.
PARTNERSHIPS WITH OTHER LABS	●*Health of the Atmosphere research partnerships.* The Aeronomy Laboratory leads the NOAA/OAR Health of the Atmosphere Research, which is carried out in a partnership of six of OAR's Laboratories (AL, ARL, CMDL, ETL, FSL, PMEL) ●*New England air quality research partnerships.* The New England Air Quality Study (NEAQS) field missions of 2002 and 2004 are carried out in a partnership of 6 of OAR's Laboratories (AL, AOML, CMDL, ETL, FSL, PMEL) ●[*Air quality forecasting collaboration.* The Aeronomy Laboratory (atmospheric chemistry) is collaborating with Air Resources Laboratory (air quality forecast model development) in the new NOAA air quality forecasting product line. Please see below.] ●*Upper atmosphere research.* Upper atmosphere research is carried out in partnership with SEC. ●[Several Laboratories collaborate with the Aeronomy Laboratory-led Atmospheric Chemistry and Climate Project of the OAR/OGP Climate and Global Change Program. Please see below.] ●*Collaborative field and individual investigator research.* As a measure of collaboration, joint authorship of research papers is included in the following: ETL, CMDL, GFDL, FSL, PMEL, ARL *Through these relationships as well as those through relationships via other OAR Programs (see below), the Aeronomy Laboratory has partnerships with 7 OAR Laboratories.*

OTHER OAR PROGRAMS	●*Climate Observations and Services Program.* The Aeronomy Laboratory is on the Board of this NOAA-wide program. The Aeronomy Laboratory leads the Climate Forcing component. Other participating OAR Laboratories include CMDL, ETL, PMEL. ●*NOAA Climate and Global Change Program/OAR Office of Global Programs/Atmospheric Composition and Climate Project.* The Aeronomy Laboratory leads this project. Colleagues in CMDL and GFDL are involved in this research partnership.
OTHER NOAA RELATIONSHIPS	●*Development of operational air quality forecasts (joint OAR and NWS).* The Aeronomy Laboratory has played a leading role in fostering the development of a new NOAA forecasting capability, namely, air quality forecasting. The Aeronomy Laboratory is providing atmospheric and laboratory observations of the chemical species involved in regional air quality. With these observations, the Aeronomy Laboratory is evaluating the chemical forecasting skill of current ARL/NWS forecast models. Similarly, the Aeronomy Laboratory is providing the new atmospheric process understanding needed to develop the next generation of the joint OAR/NWS air quality forecast product line. ●*Climate Observations and Services Program (joint OAR and* ***N****ESDIS****,*** *NWS, NOS, NMFS).* The Aeronomy Laboratory is active in the scientific leadership of the NOAA-wide Climate Observations and Services Program, which is a matrix-managed program involving all of NOAA's Line Offices. ●*Program Management in NOAA's Climate Goal.* The Aeronomy Laboratory is leading the program management of the Climate Forcing program component of the NOAA Climate goal. ●*Program Management in NOAA's Weather and Water Goal.* The Aeronomy Laboratory is leading the program management of the Air Quality program component of the NOAA Weather and Water goal.

OTHER FEDERAL AGENCIES	●*CENR Subcommittee leadership.* The Aeronomy Laboratory is a Cochair of the Air Quality Research Subcommittee of the administration's multiagency Committee on Environment and Natural Resources. ●*U.S. Climate Change Science Program (CCSP) and Global Change Research Program (GCRP).* The Aeronomy Laboratory (and NASA) led the authorship of the Atmospheric Composition chapter of the Strategic Plan of the CCSP (released July 2003). The CCSP and GCRP are coordinating the national research effort on climate. ●*National Aeronautics and Space Administration (NASA).* The Aeronomy Laboratory conducts joint projects with NASA, particularly in the areas of ozone-layer and climate research. NASA has provided a portion of the funding for many collaborative field missions over the decades. ●*Department of Energy (DOE).* The Aeronomy Laboratory has received funding through the Atmospheric Radiation Measurement (ARM) program of DOE. ●*Partnerships through multi-agency national and international organizations.* Federal partnerships are established through multi-agency organizations such as the Air Quality Research Subcommittee (AQRS) of the Committee on Environment and Natural Resources (CENR), the U.S. Climate Change Science Program (CCSP), and the North American Research Strategy for Tropospheric Ozone and Aerosols (NARSTO) (see above and below). Federal agencies involved in these partnerships include: Environmental Protection Agency (EPA), Department of Energy (DOE), National Science Foundation (NSF), Department of Interior (DOI), Department of Defense (DOD), Department of Transportation (DOT), U.S. Department of Agriculture (USDA), and NASA. ●*Partnerships through multi-investigator field missions or individual research collaborations in air quality, climate, and ozone-layer research.* Currently as well as in recent past years, many federal scientific partnerships are forged via joint field missions research. As a measure of collaboration with other federal agencies, joint authorship of research papers is included in the following: NASA, DOE, EPA, Brookhaven National Laboratory, Naval Research Laboratory, Pacific Northwest National Laboratory, Argonne National Laboratory, Lawrence Berkeley National Laboratory, Tennessee Valley Authority, and DOD.

STATE AGENCIES	*Air quality research partnerships with state agencies.* The Aeronomy Laboratory's research on air quality has been conducted in partnership with state agencies involved in air quality management. ●*State of Texas.* Prominent among AL partnerships with state agencies is a current one with the State of Texas agency, the Texas Commission on Environmental Quality (TCEQ). The Aeronomy Laboratory was a major participant in the 2000 Texas Air Quality Study (TexAQS2000), which provided the TCEQ with new insights into the underlying factors that influence the Houston region's air quality. As a result, the TCEQ has developed new approaches for the State's air quality program. As noted by TCEQ's Deputy Director in a 9 September 2003 letter to VADM Lautenbacher, "NOAA's discoveries during the [TexAQS2000] study have allowed for the development of cost-effective strategies that will result in cleaner air." The TCEQ has requested further research from NOAA to continue to aid its efforts to improve the regional air quality. An Aeronomy Laboratory scientist is on the advisory panel of the Texas Environmental Research Consortium, a state agency that funds air quality research in Texas. ●*New England States.* The Aeronomy Laboratory's research in New England has been done in partnership with state air quality agencies in that region of the nation. Agencies include: New Hampshire Department of Environmental Services; Maine Department of Environmental Protection; New York State Department of Environmental Conservation; Northeastern States For Coordinated Air Use Management (NESCAUM).
LOCAL PARTNERSHIPS	●*National Center for Atmospheric Research (NCAR; Boulder, Colorado).* Aeronomy Laboratory scientists conduct joint research projects on air quality and climate science topics with scientists at NCAR. ●Other local partnerships include the University of Colorado and CIRES, described in more detail in categories listed above and below.

UNIVERSITY PARTNERSHIPS	●*University of Colorado (CU).* A majority of the Aeronomy Laboratory's staff is associated with the NOAA/CU Joint Institute, CIRES (see Joint Institutes category above). In addition, 2 AL federal scientists are adjoint professors at CU. The Aeronomy Laboratory is also host to undergraduate and graduate students from CU and often hires recent CU doctoral graduates for postdoctoral research at AL. Several CU alumni are among the federal and CIRES staff of the Aeronomy Laboratory. ●*University of New Hampshire (UNH).* In its air quality research, the Aeronomy Laboratory maintains a close scientific and planning partnership with scientists at UNH. Major joint efforts are through the New England Air Quality Study (NEAQS 2002 and next year's major field effort in NEAQS 2004). ●*Individual research collaborations with joint Aeronomy Laboratory/university Principal Investigators.* In any given year, the Aeronomy Laboratory scientists conduct research projects and/or field missions that are joint with collaborators in other universities. As a measure of collaboration, joint authorship of research papers is included in the following: Georgia Institute of Technology, University of New Hampshire, Harvard University, University of California-Irvine, Pennsylvania State University, California Institute of Technology, Plymouth State College, University of Maryland, Woods Hole Oceanographic Institution, Michigan Technical University, Florida State University, University of Washington, State University of New York at Albany, University of Iowa, Arizona State University, University of Utah, University of California San Diego, University of Denver, Colorado State University, University of Maryland, Yale University, Hampton University, University of Wisconsin Madison, New Jersey Institute of Technology, University of California at Los Angeles, University of California Berkeley, St. Cloud State University (MN), University of Virginia, University of Alabama Huntsville, New Mexico Institute of Mining and Technology, University of Tulsa, George Mason University, Ohio University.

INTERNATIONAL	●*World Meteorological Organization (WMO), United Nations Environment Programme (UNEP), and European Commission (EC).* An Aeronomy Laboratory scientist has co-chaired the international state-of-science updates on the ozone layer provided to the United Nations "Montreal Protocol on Substances the Deplete the Ozone Layer" since 1986. In addition, Aeronomy Laboratory scientists have played leading roles in authoring the report, and have served as coauthors, contributors, reviewers, and coordinating editor. With NOAA, the WMO, UNEP, EC, and NASA are co-sponsoring organizations of this effort. ●*Intergovernmental Panel on Climate Change (IPCC).* An Aeronomy Laboratory scientist is serving as international co-chair of Working Group I (Science) of the IPCC since 2002. In addition, Aeronomy Laboratory scientists were lead authors of the Technical Summary and Summary for Policymakers, as well as two of the report's detailed chapters, of the most recent scientific state-of-understanding update of the IPCC (2001). Throughout the last decade, Aeronomy Laboratory scientists have contributed to the IPCC assessment report as authors, coauthors, contributors, and reviewers. ●*World Climate Research Program. (WCRP)/ Stratospheric Processes and their Role in Climate (SPARC).* An Aeronomy Laboratory scientist serves as co-chair of the scientific steering committee of SPARC's Upper Atmosphere-Lower Troposphere group. This effort brings together effective groups of scientists from around the world to set research directions and initiate research activities regarding the global middle and upper atmosphere. ●*International Geosphere/Biosphere Programme (IGBP)/International Global Atmospheric Chemistry (IGAC) activity.* Aeronomy Laboratory scientists serve as cochairs of this activity, a highly collaborative international scientific setting that guides research on the chemistry of the lower atmosphere. ●*IGBP/Intercontinental Transport and Chemical Transformation (ITCT) activity.* Aeronomy Laboratory scientists led the conception, design, and initiation of this new (since 2000) international research activity of the IGBP. International partners in co-leading this endeavor include scientists from the University of East Anglia (UK) and the University of Tokyo (Japan). ●*North American Research Strategy for Tropospheric Ozone and Aerosols (NARSTO).* This is a partnership of scientists, air quality planners, industry representatives, and decisionmakers from the U.S., Mexico, and Canada. The Aeronomy Laboratory was in the key leadership that initiated this partnership in 1995. Aeronomy Laboratory scientists continue to be prominent in the scientific leadership, planning, and coordination of this activity. ●*Hong Kong and Pearl River Delta (HK & PRD) Pilot Air Monitoring Project.* An Aeronomy Laboratory scientist is a member of the Scientific Advisory Committee of this Project, which is carrying out ozone/fine-particle studies to provide information to more effectively manage the air quality of that region. The ~2-year project is a collaborative effort involving several partners in China and the U.S. Participants from China include the Environmental Protection Department of Hong Kong, Guangzhou Research Section of Environmental Sciences, Hong Kong Observatory, Hong Kong Polytechnic University, Hong Kong University of Science and Technology, and Peking University; U.S. partners include Argonne National Laboratory, California Institute of Technology, and Georgia Institute of Technology. ●*Core Strategic Measurements for Atmospheric Science (COSMAS).* An Aeronomy Laboratory chairs this committee of the UK National Environmental Research Committee. ●*Research collaborations on field missions and in investigations joint with Aeronomy Laboratory Principal Investigators.* As a measure of collaboration, joint authorship of research papers is included in the following examples of current and recent collaborations: Meteorological

PRIVATE SECTOR	●*Radian/Sonoma Technology*. The Aeronomy Laboratory has two Cooperative Research and Development Agreements (CRADAs) pertaining to the wind-profiling radars. ●*Oriel Instruments*. The Aeronomy Laboratory has a CRADA with Oriel concerning a photolytic converter for use in the detection of atmospheric nitrogen dioxide (NO_2). ●*National Environmental Respiratory Center (NERC)*. The Aeronomy Laboratory is providing requested scientific information and expertise about pollutant emissions from coal-burning activities to NERC, which is a government-industry program of information and laboratory research to improve understanding of the effects of complex mixtures of outdoor environmental air pollutants on human health. ●*Houston consortium of industries*. The Aeronomy Laboratory's air quality research in the 2000 Texas Air Quality Study has led to partnerships with information customers in the Texas energy industry. These partners are active in the discussions of past scientific findings and in the planning of future research activities in the Houston region. ●*Individual research collaborations (field missions, joint authorship of research papers, or other investigations) involving Aeronomy Laboratory and private sector Principal Investigators*. Examples include: Aerodyne Research, Inc. (MA); Atmospheric and Environmental Research, Inc. (MA); Atmospheric Research and Analysis (TX), The Aerospace Corporation (CA), RJH Scientific, Inc. (CA), Mount Washington Observatory (NH); Spec, Inc. (CO).